Musical Harmony and Dissonance: The Mathematical Quantification and Analysis of Two-Note Intervals on the Piano

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Harmony and dissonance are two general classifications of sound heard when listening to musical chords. Except for electronically generated pure tones, every note has overtones which are faint notes sounding in the background. This research aims to mathematically explain why chords sound either consonant or dissonant by analyzing relationships between the overtones of the notes that create a chord. Using Fourier Transform to plot sounds in terms of frequency vs. amplitude, graphs were generated from recordings of a variety of different types of chords. Each graph shows plots of the individual notes and concurrent notes of the chord. Since peaks on the graphs represent overtones, when individual notes' peaks match, the subsequent chord superpositions and creates a harmonious chord. Regarding two-note chords within the same octave, none of the overtones of dissonant chords above -50 dB matched, whereas the overtones of consonant chords above -50 dB matched as many as 6 times and on average 2.5 times more than dissonant chords. However, many of the consonant types of chords had only one or two matches, suggesting that, even though there is a clear difference between consonant and dissonant chords, it is not black and white, but a spectrum.

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